

Course plan

Course code : ME 1191
Course title : Instrumentation & Control
Semester : 4
Academic year / semester : 2014-'15 / Even
(Dec – Apr, 2014-15)

Date : 10. Dec .2014

Section details:

Sec	Class Room No.	Details of Faculty member				Student contact time
		Name	Room No.	Intercom No.	e-mail id	
		Mr. Naveen John Punnoose	AB102	-	naveenjohn.p@ktr.srmuniv.ac.in	1.00 to 1.15 pm

Direct assessment details:

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test - I	10	Up to- Unit II: accelerometers	09.02.15	100 minutes
Surprise test	05	Unit I & II	-	10 – 15 min
Cycle test - II	10	Up to – UNIT III	09.03.15	100 minutes
Model examination	20	Full Syllabus	15.04.13	3 hours
End semester examination	50	Full Syllabus		3 hours
Attendance	05			

Syllabus of the course:

		L	T	P	C
ME1191	Robotics Engineering and Applications	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To enable the students to understand the fundamentals of instrumentation and control available for monitoring/measuring in domestic / industrial applications.

INSTRUCTIONAL OBJECTIVES

- 1) To learn fundamentals of various types of Transducers.
- 2) To acquire basic understanding of principle & working of Transducers
- 3) To Understand the methods to analyze the stability of systems from transfer function forms

UNIT I: MEASUREMENT OF FORCE, TORQUE AND VELOCITY (9 HOURS)

Electric balance, Different types of load cells, Magnets, Elastic load cell, Strain gauge load cell, Different methods of torque measurement - Strain gauge - Relative regular twist- Speed measurement - Revolution counter – Capacitive tacho - Drag up type tacho - D.C and A.C. tacho generators - Stroboscope.

UNIT II: MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY (9 HOURS)

Accelerometers – LVDT, piezo-electric, strain gauge and variable reluctance type, accelerometers - Mechanical type vibration instruments - Seismic instruments as an accelerometer and vibrometer - Calibration of vibration pickups - Units of density - Specific gravity and viscosity used in industries - Pressure head type densitometer - Float type densitometer - Ultrasonic densitometer.

UNIT III: MEASUREMENT OF PRESSURE & TEMPERATURE (9 HOURS)

Units of pressure - Manometers - Different types - Elastic type pressure gauges - Bourdon tube bellows - Diaphragms - Electrical methods - Elastic elements with LVDT and strain gauges - Measurement of vacuum - Different types- McLeod gauge - Testing and calibration of pressure gauges - Dead weight tester. Bimetallic thermometers - Electrical methods of temperature measurement – RTDs and their - Thermocouples, Pyrometers - Optical pyrometers - Two colour radiation pyrometer

UNIT IV: TRANSFER FUNCTIONS (9 HOURS)

Definitions. Transfer function - Mathematical modeling of mechanical (translation and rotational) and electrical systems. Mechanical - Electrical analogies. Block Diagram reduction techniques and Signal flow graphs.

UNIT V: RESPONSE AND STABILITY ANALYSIS (9 HOURS)

Time response of first order and Second order systems - Concept of stability - Necessary conditions for stability - Routh Stability criterion - Polar and Bode plots - Simple Problems.

TEXT BOOKS

- Ernest O. Doebelin, "*Measurement systems Application and Design*", International Student Edition, VI Edition, McGraw-Hill Book Company, 1998.
- Jain.R.K, "*Mechanical and Industrial Measurements*", Khanna Publishers, New Delhi, 1999.
- Katsuhiko Ogata, "*Modern Control Engineering*", 2nd ed., Prentice Hall of India, New Delhi, 1995

REFERENCE BOOKS

- Patranabis.D, "*Principles of Industrial Instrumentation*", Tata McGraw-Hill Publishing Ltd., New Delhi, 1999.
- Sawhney.A.K, "*A course in Electrical and Electronic Measurement and Instrumentation*" Dhanpat Rai and Sons, New Delhi, 1999.
- Benjamin C Kuo, "*Automatic Control System*", 7th edition, Prentice Hall of India, New Delhi, 1993.
- K. Krishnaswamy. "Industrial Instrumentation", New age international, 2003

		L	T	P	C							
ME0002	INSTRUMENTATION AND CONTROL	3	0	0	3							
	Prerequisite											
	Nil											
Student outcomes	Program Educational Objectives											
	The main objective of the B.Tech in Mechanical Engineering Program is to provide a periodically-updated curriculum so that, following the completion of the program and with a few years of experience, our alumni will have the expertise to:											
	1. To learn fundamentals of various types of Transducers.	2. To acquire basic understanding of principle & working of Transducers	3. To Understand the methods to analyze the stability of systems from transfer function forms									
	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	X	X	X								
(d) an ability to function on multidisciplinary teams	X	X	X									
(e) an ability to identify, formulate, and solve engineering problems	X	X	X									
Course designed by	Department of Mechanical Engineering											
1	Student outcome	a	b	c	d	e	f	G	h	i	j	k
				x		x						
2	Category	GENERAL (G)		BASIC SCIENCES (B)		ENGINEERING SCIENCES AND TECHNICAL ART (E)			PROFESSIONAL SUBJECTS (P)			
												X
3	Broad area (for professional courses only, i.e 'under P' category)	Manufacturing			Design		Thermal		General			
						X						
4	Course Coordinator	Mr. NAVEEN JOHN PUNNOOSE										

COURSE PLAN -2014-2015

ME1191 – INSTRUMENTATION AND CONTROL

S.NO	TOPICS	HOURS	CHAPTER
MEASUREMENT OF FORCE, TORQUE AND VELOCITY			
1	Introduction to transducers and measuring instruments	1	T1, Ch2
2	Methods of force measurement, Types of load cells- Magnetic load cell	1	T1, Ch5
3	Elastics of Load cell, and its characteristics – Problems, Strain gauge load cell	2	T1,Ch5
4	Methods of Torque measurement. Contact type – Strain Gauge –principles & problems, Relative regular twist type	1	T1, Ch5
5	AC & DC tacho generators, Drag type tacho generator, Capacitive type tacho generator	2	T2, Ch10
6	Non contact torque measurement – Stroboscope, Speed measurement – revolution counters, Optical Encoders – Incremental & Absolute	2	T1, Ch4
MEASUREMENT OF ACCELERATION, VIBRATION & DENSITY			
7	Introduction to Accelerometers - Differential Transformers – LVDT, RVDT, Piezo-Electric	2	T1, Ch4
8	Strain Gauge and Variable Reluctance types	1	T1, Ch4
9	Introduction to Vibrometers & Seismic instruments, Mechanical type vibration instruments – Seismic Displacement pickups – translational & rotational pickups	2	T1, Ch4
10	Use of Accelerometers as Seismic instrument, Calibration of vibration pickups, jerk pick up	2	T1, Ch4
11	Units of density, Specific Gravity and Viscosity measurements used in Industries – examples	1	R3, Ch4
12	Pressure head type Densitometer, Float type Densitometer, Ultrasonic Densitometer	1	R3, Ch4
MEASUREMENT OF PRESSURE & TEMPERATURE			
13	Units of Pressure and basic methods of Pressure measurement	1	T1, Ch6
14	Manometers – U type, Well –type, Barometer, inclined Manometer, Micro manometer	1	T1, Ch6
15	Elastic pressure transducers, bourdon tube – types , bellows -types	1	T1, Ch6
16	Electrical methods – LVDT, strain gauges	1	T1, Ch6
17	Vacuum measurement – Diaphragm Gauges, McLeod gauge	1	T1, Ch6
18	Testing and calibration of Pressure Gauges - dead weight method, relative comparison method	1	T1, Ch6
19	Temperature measurements – Bimetallic sensors - types	1	T1, Ch8
20	Electrical methods – RTDs – types, thermocouples – types, related problems	1	T1, Ch8
21	Pyrometry – Optical & radiation	1	T1, Ch8

TRANSFER FUNCTIONS			
22	Examples of control systems, definitions, transfer functions	1	T3, Ch 1-2
23	Block diagrams, Open loop vs. closed loop, Industrial controllers (PID)	2	T3, Ch2
24	Mathematical modeling of Mechanical (translational & rotational) systems	2	T3, Ch3
25	Electrical systems – Mechanical-Electrical analogies, Problems	2	T3, Ch3
26	Block diagram reduction techniques	1	T3, Ch2
27	Single flow graphs- basic elements, algebra	1	R4, Ch3
RESPONSE AND STABILITY ANALYSIS			
28	First order systems – unit step, time response characteristics – overshoot, time constant, settling time	2	R4, Ch7
29	Second order systems – characteristics damping , Steady state & transient response	2	R4, Ch7
30	Concept of stability – Routh’s Stability criterion	1	T3, Ch5
31	Frequency response – Bode plots, Magnitude & Phase	2	T3, Ch7
32	Polar plots, Nyquist plots, Simple problems	2	T3, Ch7

Text Books:

T1. Ernest O. Doebelin, “*Measurement systems Application and Design*”, International Student Edition, VI Edition, McGraw-Hill Book Company, 1998.

T2. Jain.R.K, “*Mechanical and Industrial Measurements*”, Khanna Publishers, New Delhi, 1999.

T3. Katsuhiko Ogata, “*Modern Control Engineering*”, 2nd ed., Prentice Hall of India, New Delhi, 1995

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R1. Patranabis.D, “*Principles of Industrial Instrumentation*”, Tata McGraw-Hill Publishing Ltd., New Delhi, 1999.

R2. Sawhney.A.K, “*A course in Electrical and Electronic Measurement and Instrumentation*” Dhanpat Rai and Sons, New Delhi, 1999.

R3. K. Krishnaswamy. “*Industrial Instrumentation*”, New age international, 2003

R4. Benjamin C Kuo, “*Automatic Control System*”, 7th edition, Prentice Hall of India, New Delhi, 1993.

Name of the faculty:

1. Mr. Naveen John Punnoose



Dean / HOD

